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Abstract

With the social demand for childcare service diversifying and local governments becoming increasingly cash-strapped, the proportion of public nursery schools in the childcare sector has been shrinking in recent years. The funding reforms of 2004, which abolished the national subsidy to public nursery schools, are seen as one of the triggers of this phenomenon. Using a panel dataset of 983 municipalities across the nation, this paper investigates the impact of the reforms on the operating costs of public nursery schools. We found that different municipalities responded differently to the reforms. In areas with relatively large populations, fiscally stronger municipalities were likely to spend less on public nursery schools in the wake of the reforms, while municipalities in smaller cities spent more. Besides, municipalities that were not compensated for the loss of the national subsidy reduced expenditures in large cities. In small cities, on the other hand, such municipalities actually increased expenditures.

Keywords: operating cost, public nursery school, funding reform, difference-in-differences approach

JEL Code: H71, H75, H77

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1. Introduction

Preschool education and childcare services in Japan mainly involve kindergartens (*youchien*) and nursery schools (*hoikusyo*). Unlike kindergartens that provide school education (*gakko kyoiku*) to children aged 3 to 5, nursery schools offer care (*hoiku*) to infants and young children up to the age of 5 who lack childcare at home. In this sense, childcare in nursery schools is distinct from the school education system in Japan.[1] Following an increase in the number of nuclear family households and a rise in the employment rate of women, the demand for childcare service, *hoiku*, is growing and becoming more complex. In Japan, childcare is provided mainly by nursery schools, both public and private. In recent years, however, private nursery schools, which offer more flexibility, tight local government finances, and the high cost structure of public nursery schools[2] have led to a shrinking share of public nursery schools (Fig 1).

Public nursery schools in Japan are operated by the municipalities. Until the fiscal year 2003, 50% of their operating costs were subsidized by the national government as a specific purpose grant. On April 1, 2004, however, this subsidy was abolished and municipalities were required to finance all costs from their general revenues. The main purpose of this reform was to allow municipalities to become more autonomous so that they could improve their administrative efficiency and become more responsive to the increasingly sophisticated demand for childcare. Although loss of the subsidy was to be compensated with an increase in general revenues allocated through the system of Local Allocation Tax (LAT), the cost of running public nursery schools became more dependent on each municipality's fiscal situation. It is believed that this change in the funding structure accelerated the spending cuts on and the privatization of public nursery schools. For example, a survey by the Ministry of Health, Labor, and Welfare found that nearly 40% of municipalities across the nation reduced their operational budgets for public nursery schools in the 2004 budget (Takagi, 2005). According to the

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[1] In recent years, kindergartens have been increasingly merged with nursery schools.

[2] Hayashi (1996) examined cost differences between public and private nursery schools in 31 municipalities in Osaka prefecture. Owing to data availability constraints, he used the total cost of child welfare services as a proxy for the cost of nursery schools. He reported that a one percent increase in the share of public nurseries' total capacity induces an increase in the cost of child welfare services per child of 7,868 Japanese yen. This is attributed to the additional allocation of staff in public nursery schools and their higher cost because nursery staff tends to be older.

results of the survey [3] conducted by the Japan Childcare Association (JCA), municipalities spent on average 2.4% less per enrolled child in a public nursery school in 2007 compared with 2003. In cities with populations of more than 300,000, the reduction was as high as 5% on average.

Many previous studies have attempted to evaluate the effects of such policy changes empirically. Ahlin and Mörk (2008) looked at whether the policies of educational decentralization in Sweden caused any structural changes to local school expenditures by simply applying interaction terms of localities' fiscal characteristics such as tax base and total intergovernmental grants and year dummies that took the value 1 after the reform. Applying the same estimation method, Kobayashi and Hayashi (2011) examined how changes in funding affected municipal expenditures on Japan's School Expense Assistance (SEA) program. Using panel data for 2004 and 2007 to examine the reforms of 2005, they showed that municipalities' financial strength affected SEA benefits per recipient more after the reforms. With recent developments of quasi-experimental methods, such as the difference-in-differences (DID) approach, a number of studies have studied the effects of administrative or fiscal reforms in various policy fields. In the field of education, for example, Wang et al. (2011) investigated how provincial-level reforms affected local education expenditures in China. They concluded that counties that were subject to reforms tended to spend less on public education than other counties. In the field of childcare services, Mörk et al. (2013) identified the causal effect of childcare costs on fertility rate, in the context of exogenous variation in household user charges caused by Swedish childcare reforms. In Japan, Ohtake and Sano (2009) and Hayashi and Kobayashi (2010) investigated the effects of money transfers from government disbursement to LAT on compulsory educational expenditures and on SEA benefits, respectively.

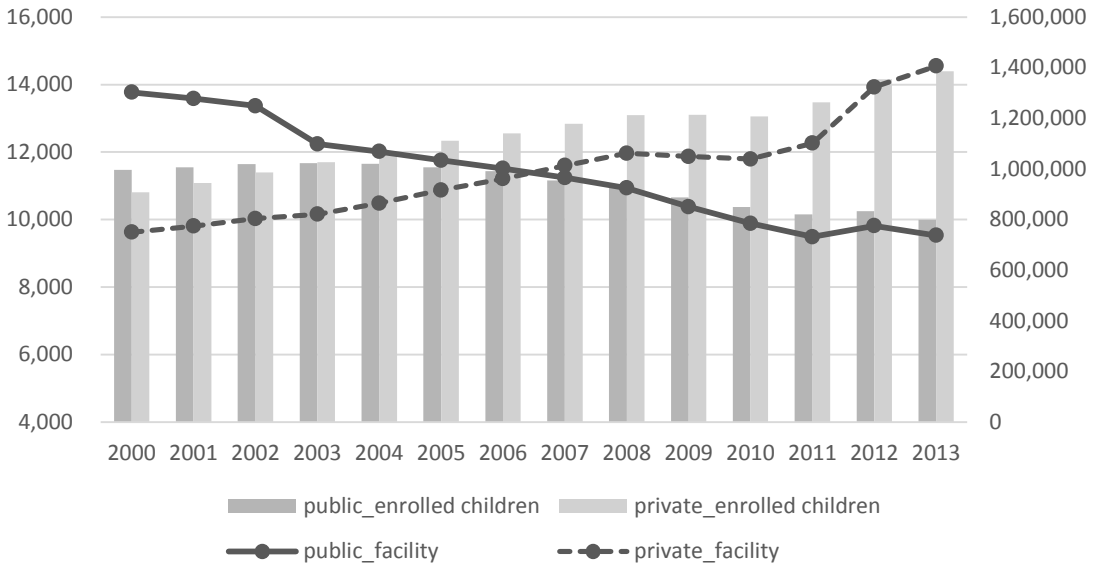
Although the negative impact of the reforms on public nursery schools seems obvious, we have not found any empirical investigation so far. Did the reforms actually trigger municipalities' lower spending on public nursery schools? If this were true, which were the municipalities that were worst hit? This study investigates empirically

[3] The survey, conducted on April 1, 2007, targeted 807 municipalities across the country. The collection ratio was 73.5%. (http://www.nippo.or.jp/news/pdfs/outline.pdf)

the impact of the change in funding scheme on the operational costs of public nursery schools. More specifically, we investigate the impact of the change in fiscal strength on the operational costs of public nursery schools before and after the reform. Second, we examine the impact of the reform by focusing on the revenue compensation through LAT being applied only to specific municipalities. We found that municipalities responded differently to the reform according to the size of the cities in which they operated. In areas with relatively large populations, fiscally stronger municipalities were likely to spend less on public nursery schools in the wake of reforms, while spending more in smaller cities. Besides, municipalities that were not compensated for the loss of national subsidy reduced their expenditures in large cities. But in small cities, such municipalities actually increased expenditures. After controlling for other factors, we did not find any significant impact of the reform on municipalities' expenditures on public nursery schools in towns and villages.

This paper is organized as follows. Section 2 describes the funding system for public nursery schools in Japan, before giving an overview of the 2004 reforms and their impact on the public nursery school sector. Section 3 details the study's empirical strategy and the data. Section 4 presents the results of our estimation, and Section 5 concludes the paper.

Fig 1: Ownership pattern of nursery schools and their enrolment



Source: author (refer to the Survey of Social Welfare Institutions)

2. Institutional background

2.1 The funding system for public nursery schools

The Child Welfare Act in 1947 mandates that municipalities (cities, towns, and villages) are responsible for taking care of children who lack sufficient care in either public or private nursery schools. The operating costs of public nursery schools comprise mainly personnel, service, and administrative expenses, which are funded by both the government and a household user charge. The total operational cost is estimated based on the unit price (monthly operational cost per enrolled child), which is legally defined by the national government. This depends on the age of the child (0–1, 2–3, and 4–5), the capacity of the nursery school, and the size of the municipality it is located in. The national government also sets the user charge based on the child's age, the number of enrolments, and household income. However, each municipality can decide upon the actual user fee charged.

Fig 2 shows the funding system for public nursery schools. Until 2003, 50% of the estimated total operating costs, after deducting the user charge, were taken care of by the national government. The other half was funded by the prefecture (the local government unit above the municipality) and by the municipality. Although the unit price is supposedly set at a level that ensures universal and quality childcare across the country, the amount is seen as too low to fulfill the actual local demand for childcare. As a result, there is a significant gap between the legally determined operating cost and the actual cost. Kimura and Sugiyama (2009) pointed out the following specific problems with the current national standard: the estimated minimum requirement of nursery schools is too low; the estimated expense on nursery staff is much lower than what is actually required; and, considering the growing demand for childcare services, an opening time of eight hours per day is too short. Moreover, in most cases, municipalities disregard the set user charge and determine their own charge for households in order to reduce the burden on households. All these factors resulted in municipalities having to spend more on public nursery schools to ensure quality childcare by hiring better-paid staff or offering special care. This puts pressure on local governments operating under tight budgets.

Fig 2: The funding system for public nursery schools

(a) Legally defined operating cost

<table>
<tr><td colspan="4">Total operating cost (national standard) (A)</td></tr>
<tr><td colspan="3">Public expense (C) = (A) − (B)</td><td rowspan="2">User charge (national standard) (B)</td></tr>
<tr><td>The national government (C) × 50%</td><td>Prefecture (C) × 25%</td><td>Municipality (C) × 25%</td></tr>
</table>

(b) Actual cost before the 2004 reform

<table>
<tr><td colspan="5">Total operating cost (actual expense) (A)</td></tr>
<tr><td colspan="3">Public expense (C) = (A) − (B)</td><td rowspan="2">Municipality's additional expense</td><td colspan="2">User charge (national standard) (B)</td></tr>
<tr><td>The national government (C) × 50%</td><td>Prefecture (C) × 25%</td><td>Municipality (C) × 25%</td><td>Municipality exemption</td><td>Municipality standard</td></tr>
</table>

(c) Actual cost after the 2004 reform

<table>
<tr><td colspan="4">Total operating cost (actual expense) (A)</td></tr>
<tr><td colspan="2">Public expense (C) = (A) − (B)</td><td rowspan="2">Municipality's additional expense</td><td colspan="2">user charge (national standard) (B)</td></tr>
<tr><td colspan="2">Compensation through Local Allocated Tax (LAT)</td><td>Municipality exemption</td><td>Municipality standard</td></tr>
</table>

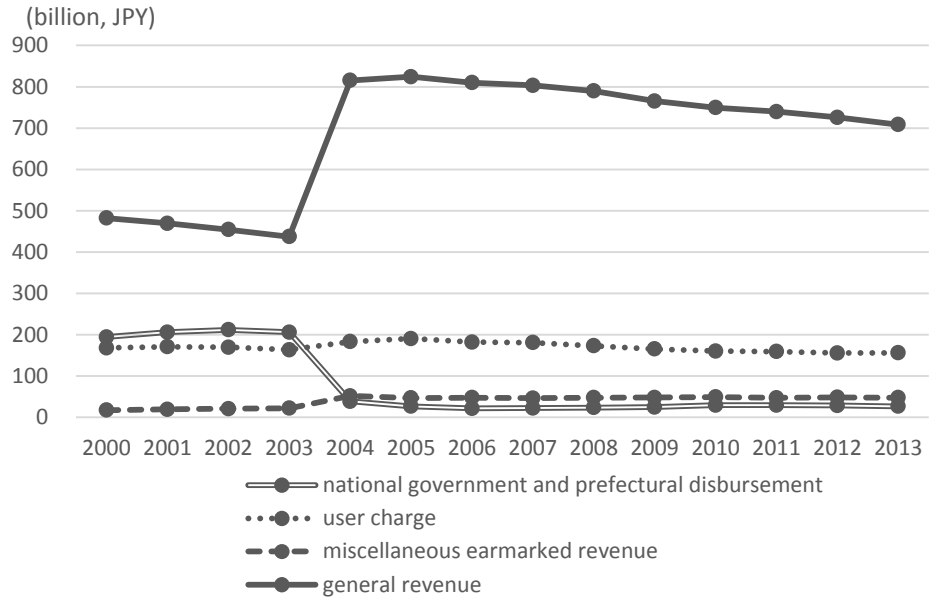
Source: Author

2.1 The 2004 reform

Until March 2004, 50% of the public expense was subsidized by the national government as a specific purpose grant. On April 1, 2004, however, this national government subsidy system was abolished in the wake of decentralization; approximately 166 billion yen were moved from national to local tax revenues. At the same time, prefectural disbursements were also abolished. As a result, municipalities had to take responsibility for financing public nursery schools from their own budgets. The burden on municipalities reached 332 billion yen in the fiscal year 2004 (Osawa, 2004; p.106). Fig 3 shows the trend in accumulated total operating costs for public nursery schools by revenue source. It is clear that since the 2004 reforms, the share of national and prefectural disbursement decreased, while the share of general revenues

increased significantly. Although the increase in general revenue was more significant than the decrease in specific grant in the immediate aftermath of reforms, the proportion soon began to decline steadily. Yamamoto (2011), who analyzed the financial situation of public nursery schools in Fujinomiya city in Shizuoka prefecture, reported that cuts of personnel expense accounted for a large share of decrease in general revenues after the reforms.

Fig 3: Trend in revenue sources of public nursery schools



Source: Author (refer to the Survey of Local Finance Situation)

The losses of both the national government subsidy and prefectural contributions were to be compensated by an increase in general revenues from the LAT system (Fig 2-(c)). LAT, which is a general-purpose grant, is an allocation of money made by the national government to each local government to guarantee standard and universal public services regardless of disparities in local revenue sources. The amount of LAT is determined by the difference between local governments' Basic Fiscal Needs (BFN) and its Basic Fiscal Revenue (BFR). As long as BFN exceeds BFR (BFN/BFR>1), the relevant amount of LAT allocation is made. After the 2004 reforms, the operating costs of public nursery schools were also taken into account in the calculation of BFN. Therefore, as Hayashi and Kobayashi (2010) pointed out, if the municipalities were

LAT recipients, the total revenue from the national government could be regarded as the same both before and after the reforms. However, for non-LAT recipients, the reforms simply meant lower revenues.

Of course, there was no guarantee that LAT recipients would not reduce operating costs since LAT is an unconditional revenue source. As mentioned in the Introduction, Takagi (2005) and the JCA (2007) reported that many municipalities cut their operating budgets for public nursery schools significantly after the reforms. Moreover, the nationwide survey conducted by the JCA in 2005 also reported different reactions in regions with municipalities of different sizes. Based on a grouping of six regions according to their population size,[4] the JCA reported that cost cutting was more significant in areas with relatively larger populations than in other areas with smaller populations. Specifically, in those cities with the largest populations, the percentage of public nursery schools which reported the cost cut of childcare services after the reform was the highest, reaching 47.6%, with 31.6% being the average; in places with the smallest populations, such as towns and villages, up to 51.7% (48.3% on average) of public nursery schools said their budgets remained almost the same. Underpinning these different reactions is the position that public nursery schools hold in different areas. In urban areas, where the employment rate of women is high, demand for childcare is likely to be greater and more complex than in rural areas. In response to this demand, not only public but also the growth of private nursery schools has been significant. In rural areas, on the other hand, public nursery schools continue to dominate. Thus, it is reasonable to expect that depending on the size of cities, local governments would respond differently to the reforms.

[4] The JCA (2005) investigated changes in the local financial situations of public nursery schools after the reform. A questionnaire was submitted to 689 nursery schools, of which 291 were public schools and 398 were private. The regions were divided into the following groups: special wards and designated cities; prefectural capital cities; core cities with populations of more than 150,000; small cities with populations of more than 50,000 and less than 150,000; small cities with populations of less than 50,000; and towns and villages.

3. Test strategy and data

3.1 Empirical strategy

We use the panel dataset of a Japanese municipality to analyze the effects of the 2004 reforms on municipalities' expenditures on public nursery schools. Our main purpose is to examine if there was any change in the impact of fiscal strength on public nursery school expenditures before and after the reforms and to estimate the average treatment effect of the reform. Since the census survey we used is conducted every five years, we can only use a five-year interval dataset. Besides, the number of enrolled children after 2005 is not available from our data source.[5] Hence, we use municipality panel data with a five-year interval from the years 2000 and 2005. In addition, we eliminate consolidated municipalities from our observations. Our final dataset is unbalanced panel data from 1,906 observations covering 983 municipalities in the years 2000 and 2005. To answer the first question, we will estimate the following empirical model based on the specification approach used by Ahlin and Mörk (2008) and Kobayashi and Hayashi (2011).

$$y_{it} = \alpha_0 + (\beta_1 + \beta_2 D_{2005}) FISCAL_{it} + \boldsymbol{\gamma}\mathbf{X}_{it} + v_i + v_t + \varepsilon_{it} \qquad (1)$$

where y_{it} denotes operating costs for public nursery schools per enrolled child in municipality *i* in year *t*. **X** is the vector of independent variables that can influence cost. v_i, v_t, and ε_{it} are unobserved municipality-specific fixed effect, year effect, and an idiosyncratic error term ($iid{\sim}N(0,1)$), respectively.

Since we want to focus on the change in the burden on municipalities, we deduct the amount of user charges from total operating costs. D_{2005} is the dummy variable that takes the value 1 in 2005. $FISCAL_{it}$ is the variable that indicates fiscal strength; we use a fiscal capacity indicator (FCI) of municipality *i*. FCI is a simple three-year average of the numbers derived by dividing BFR by BFN, which is used to calculate ordinary LATs. In general, a higher FCI means stronger fiscal capacity. We focus on the estimated parameter of the interaction term β_2 that captures the change in the

[5] The data source is the Public Facilities Survey (Ministry of Internal Affairs and Communications [MIC]). For more details, refer to the description of data under Section 3.2.

effect of fiscal strength on childcare costs. In model (1), we assume we can capture the effects of the reform by employing a year dummy variable that takes the value 1 in 2005. However, this method may fail to identify any possible macroeconomic fluctuations during the period of analysis and the influence of funding reforms. To overcome this problem and extract more accurately the effects of the reforms, we can utilize the empirical strategy suggested by Ohtake and Sano (2009) and Hayashi and Kobayshi (2010).

Compensation for the fiscal loss through LAT can only be enjoyed by LAT recipients that are "weak" enough to manage their finances based on their own local tax revenues. Therefore, as Hayashi and Kobayashi (2010) pointed out, for non-LAT recipients, this reform implies a rise in the real price of childcare service. Thus, as long as LAT compensates exactly the same amount as the loss caused by abolishing the national grant, only non-LAT municipalities feel the impact of a decrease in revenue. Therefore, by regarding non-LAT municipalities as a treatment group and LAT municipalities as a control group, we can apply a DID approach to clarify the average treatment effect of the reform. We can interpret this effect as the income effect of LAT compensation on public nursery school expenditures. Let subscripts a and b denote "after" and "before" reforms; the change in operating costs in the treated group (i.e., non-LAT municipalities) is measured by $E_i(y_{1a} - y_{1b}|d = 1)$ and that for the untreated group (i.e., LAT municipalities) by $E_i(y_{1a} - y_{1b}|d = 0)$, where d takes the value 1 for the treatment group and 0 otherwise. Then, if the parallel trend and common trend assumptions are valid, DID is a measure $(y_{1a} - y_{1b}|d = 1) - E_i(y_{1a} - y_{1b}|d = 0)$ of the treatment effect.[6]

In this case, by defining the following regression model and obtaining the DID estimator (δ), we estimate the average treatment effects of the reform.

$$\Delta y_i = c + \delta NLAT_i + \sum \theta_k \Delta X_{k,i} + \epsilon_i \qquad (2)$$

where $NLAT_i$ indicates the dummy variable, which takes the value 1 if the municipality is a non-LAT recipient and 0 otherwise, in 2005. This model is defined as

[6] For a more detailed discussion, see Cameron and Trivedi (2005, Chapter 25).

follows and is based on Hayashi and Kobayashi (2010). Let M_{it} indicate the amount of general transfers, including LAT grants of the *i*th municipality in year *t*. A series of control variables (X_{hi}) is the same as the ones we consider in equation (1). Then, operating cost can be defined as the following linear response equation (3). Equation (2) is derived through the differentiation of equation (3).

$$y_{it} = a_t + \lambda M_{it} + \sum \theta_h X_{hit} + v_i + v_t + \varepsilon_{it} \quad (3)$$

Taking the first difference of equation (3), we get equation (4) as given below:

$$\begin{aligned}(y_{i,2005} - y_{i,2000}) \\ &= (\alpha_{2005} - \alpha_{2000}) + \lambda(M_{i,2005} - M_{i,2000}) \\ &+ \left(\sum \theta_h X_{h,i,2005} - \sum \theta_h X_{h,i,2000}\right) + (\varepsilon_{i,2005} - \varepsilon_{i,2000})\end{aligned}$$

$$\Delta y_i = c + \lambda \Delta M_i + \sum \theta_k \Delta X_{k,i} + \epsilon_i \quad (4)$$

Assuming we control for other factors in general revenues, ΔM_i will capture the net change in total expense for public nursery schools after the reforms. So long as LAT completely offsets the loss of national subsidy, ΔM_i will be equal to 0 for municipalities with $NLAT_i = 0$. Therefore, we can derive $\lambda \Delta M_i = \lambda(NLAT_i = 1)\Delta M_i + \lambda(NLAT_i = 0)\Delta M_i = \lambda NLAT_i \Delta M_i = \delta NLAT_i$ and get $\delta = \lambda \Delta M_i$. If we assume operating cost is a normal good, δ will be interpreted as the negative income effect since $\Delta M_i < 0$ for municipalities with $NLAL_i = 1$.

Fig 4 represents reform of the funding system and the DID estimator (δ) is our estimate. The operating and other costs per enrolled child are represented on the horizontal and vertical axes, respectively. Assume that before the reforms, municipalities select the optimization point *a* given the budget constraint line *AB*. After reforms, the budget constraint line for non-LAT municipalities shifts from *AB* to *AC*; therefore, the optimization point moves to *b*. On the other hand, inasmuch as LAT perfectly offsets the national subsidy, LAT municipalities will optimize at point *c* with the new budget constraint line *ED*. The DID estimator (δ) in equation (2) will capture

the difference between the decrease in LAT municipalities (from *a* to *c*) and that in non-LAT municipalities (from *a* to *b*). δ will carry a negative sign if childcare service is a normal good (the figure on the left side).

Fig 4: Impact of abolishing the national subsidy and compensation through LAT

Fig 4-1: When public childcare service is a normal good

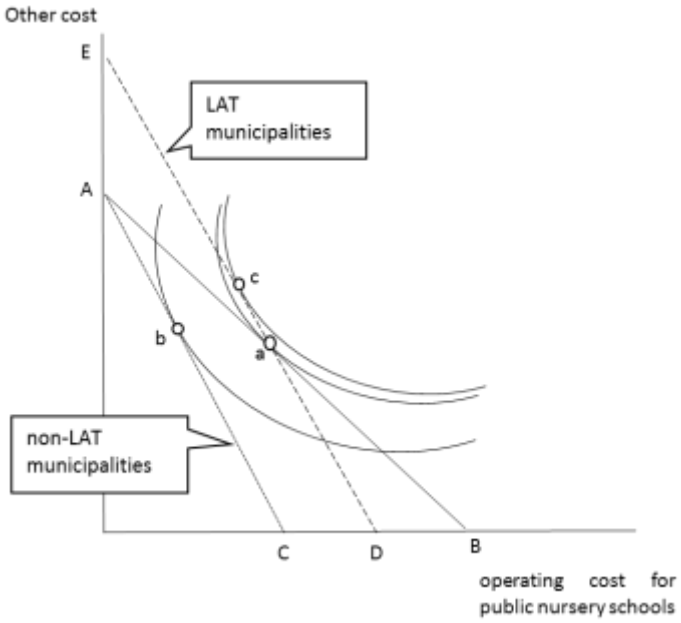
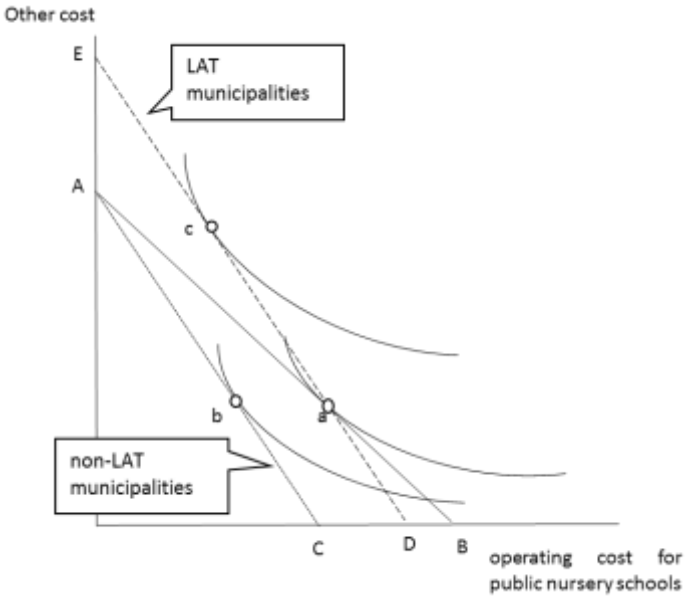


Fig 4-2: When public childcare service is an inferior good



Source: Author (refer to Ohtake and Sano (2009))

3.1 Data description

We define the dependent variable as the operating cost of public nursery schools per enrolled child in each municipality. The data is drawn from the Survey of Local Finance Situation (Ministry of Internal Affairs and Communications [MIC]). Information on the number of enrolled children and other details about nursery schools is obtained from the Public Facilities Survey (Ministry of Internal Affairs and Communications [MIC]). As for the independent variables, we first consider controls that reflect socioeconomic factors, such as population (POP), the share of preschool population in total population (PRESCHOOL), and the share of taxpayers in total population (TAXPAYER). Preschool population refers to the populations of children under the age of 5. The share of taxpayers in total population is included as an indicator of wealth. PRESCHOOL is included to capture a municipality's reaction to potential demand in the area. However, as Asada (2009) pointed out, this variable may be potentially endogenous as a result of "Tiebout sorting." That is, households with children under the age of 5 could move to an area where local childcare service is more readily available. To avoid the possible bias of coefficients in the case of OLS estimation, we run panel IV estimation additionally using the ratio of preschool population five years ago and the employment rate of women five years ago as instrumental variables. These variables are independent of the current level of municipality expense on childcare. Based on the test result of endogeneity of PRESCHOOL, we will decide which model to use. As stated in Section 2.1., childcare costs largely depend on the age structure of enrolled children. However, owing to data availability issues, we do not have the actual number of enrolled children by age in each nursery school. Therefore, we approximate the age structure of actual enrolled children by the population's age structure in each municipality, assuming municipalities offer childcare services to meet potential demand in the relevant area. That is, we consider the share of infants aged 0, of children aged 1 to 2, and of children aged 3 and above in the preschool population (R0, R1–2, and R3) to capture the effects of the different age compositions on childcare costs. These age segments meet the actual classification that the national government uses to calculate the unit price of childcare in public nursery schools. We treat the share of children aged 4 to 5 in the preschool population as a base group.

Next, we consider independent variables that relate to a nursery's management. To obtain the annual average wage of workers, we divide regular personnel expenses by the total number of administrative and nursery staff after deducting temporary staff (WAGE).[7] Higher wages would push up the operating costs. We also consider the ratio of temporary staff in total staff (TEMPORARY STAFF). The more temporary staff the municipality hires, the lower are its childcare costs. In addition, we take the effects of economies of scale into account. Hence, we include the holding capacity of public nursery schools (CAPSCHOOL). Lastly, we include the sufficiency rate of public nursery schools (SUFFICIENCY). This indicator is calculated by taking the ratio of total holding capacity of public nursery schools to the number of potential applicants in each municipality. The number of potential applicants is surveyed by each municipality's ordinance and is obtained from the Public Facilities Survey. In urban cities, a long waiting list for nursery school acceptance is considered a serious social issue. However, in rural areas with a small and decreasing population, a high vacancy rate, especially in public nursery schools, is common (Nobe, 2010). If the holding capacity exceeds the number of potential applicants, municipalities may have incentives to reduce public nursery school expenditures. Note that since all independent and dependent variables are logarithmically transformed, the estimated coefficient indicates elasticity.

In our empirical analysis, we divide our observations into several categories based on the size of municipalities to capture the difference in reactions. Although we refer to the JCA's classification standard, our dataset does not fit it exactly. We do not have data for major cities and special wards; besides, many of the prefectural capital cities that experienced consolidation are excluded from our observations. Given these issues, we use the following three categories: core cities including some prefectural capital cities (population >= 150,000); small cities (50,000 =< population < 150,000); and towns and villages (population < 50,000).[8] The sample sizes are 148, 340, and 1418, respectively.

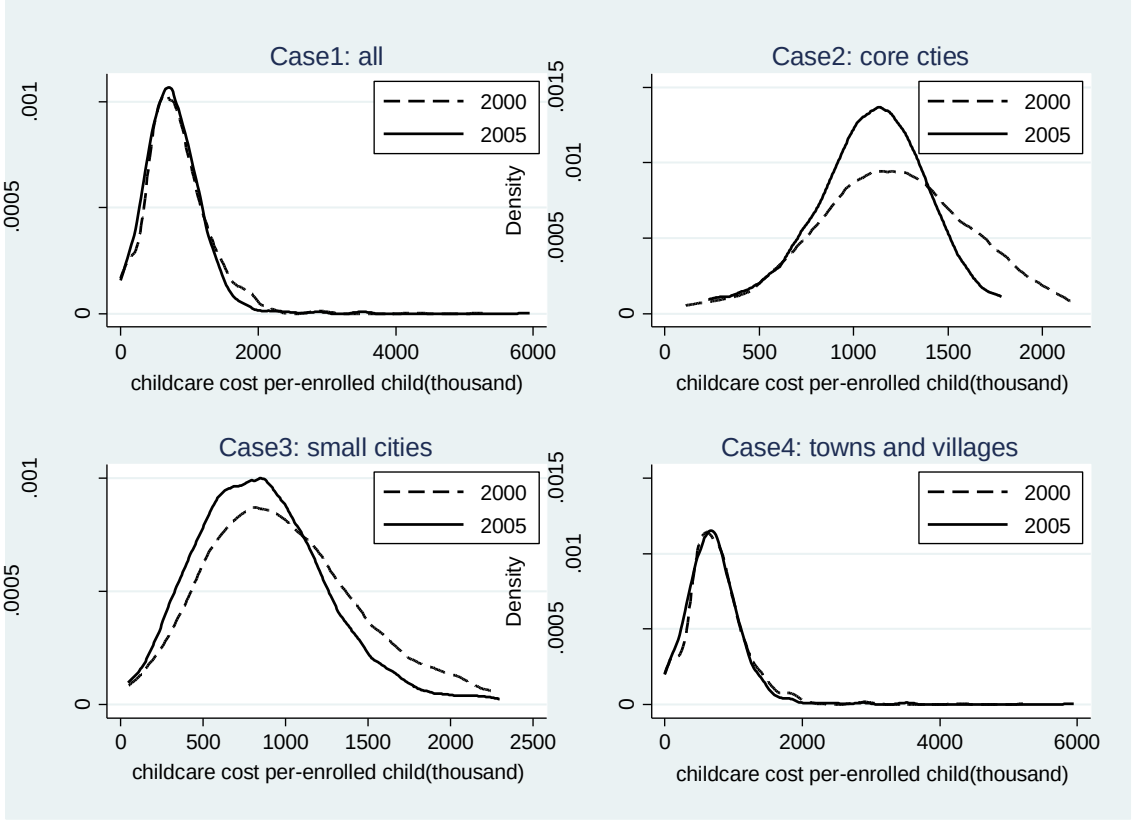
[7] Although we can get details of staff numbers by occupation and employment status, the personnel expense figure is not available.

[8] According to the Local Autonomy Act, a city is defined as a municipality if it has a population of more than 50,000. In fact, there are some parts of cities with populations of less than 50,000. Here we include such cities in category 3 as well.

Fig 5 show the distributional changes in operating costs per enrolled child in 2000 and 2005. Cases 1 to 4 show the observations of full sample, core cities, small cities, and towns and villages, respectively. As seen from cases 1 and 4, municipalities that spent relatively high amounts on childcare per child were concentrated in areas with small populations. There were seven towns and five villages that spent more than 2,500,000 yen in total. This may be because the number of enrolled children was too small in these areas. To check the robustness of estimation, we regress same models without observations whose dependent variable exceeds the range of three times as large as standard deviation.[9] The mean values of childcare cost per enrolled child fell from 831,000 yen in 2000 to 775,000 yen in 2005 (Case 1: all); from 1,208,000 to 1,089,000 yen (Case 2: core cities); from 981,000 to 857,000 yen (Case 3: small cities), and from 762,000 to 722,000 yen (Case 4: towns and villages), respectively. Although in Case 1 (full observations) we see hardly any significant change in costs between the two periods, it is obvious that the density distribution has shifted to the left side in Case 2 and Case 3. This shift in distribution implies that the operating costs per enrolled child tended to decrease overall, especially in core and small cities. As for the change in distributional variations, the values of standard deviation became smaller during the reform period in every case–from 476,000 to 448,000 yen (Case 1), from 403,000 to 300,000 yen (Case 2), from 454,000 to 396,000 yen (Case 3), and from 464,000 to 455,000 yen (Case 4), respectively. Disparities in spending seem to be smaller during this period.

[9] That is, the childcare cost per child was greater than 2,188,000 yen in the dataset of full observations.

Fig 5: Distributional changes in operating costs per enrolled child



Note: The cost is not transformed into a logarithm. The cost covered by households in the form of the user charge is exempted.

Source: Author

4. Results

Table 1 presents the estimation results of regression model (1) with full observations. We ran pooled, random-effects, and fixed-effects models, and conducted the F-test, the Brush-Pagan LM test, and the Hausman test to specify a suitable model. A series of hypothesis testing supported the choice of a fixed-effects model as most appropriate. Since our main interest here is to examine the change in the effects of fiscal strength on operating costs during the reforms, we focus on the estimated parameters of FCI (β_1) and its interaction with D_{2005} (β_2). Columns (3) and (4) show the estimation results by fixed-effects model, while column (4) shows the year effect. In both results, β_1 is statistically insignificant, implying that fiscal strength did not affect the per-child operating cost. The estimated β_2 in column (3) is positively significant at the 1% level, implying that fiscally strong municipalities tended to increase per-child operating costs after the reforms. However, once we take the year trend into consideration, the coefficient is no longer significant. According to results of the likelihood ratio test, we support the result of column (4) and conclude that there seems to be no structural change in the impact of fiscal strength on operating costs for public nursery schools. Figures in column (5) show the result by IV model. Since we cannot reject the hypothesis that PRESCHOOL is exogenous, the parameters estimated by fixed-effects models are BLUE. Therefore, we will apply the fixed-effect model to the following analysis.

Table 2 reports the results using the separated municipality scale samples. In the case of core cities, municipal fiscal strength and per-child operating cost are positively correlated (see columns (1) and (2)). This means the stronger the municipalities, the more they spend on public nursery schools. However, the estimated coefficient of the year-interaction term (β_2) is negative and significant. That is, in relatively large cities, fiscally stronger municipalities reduced operating cost more significantly after the reforms than the others. Next, in the case of small cities, there seems to be no statistically significant correlation between fiscal strength and operating cost (see columns (3) and (4)). However, post-reforms, fiscally stronger municipalities were likely to increase per-child operating costs. We confirm this tendency even after controlling for year trends. Interestingly, the effects of fiscal strength on operating costs for public nursery schools after the reform go the opposite way in core cities and

small cities. After the reform, the "richer" municipalities in core cities spent less on public nursery schools; on the other hand, the "richer" municipalities in small cities spent more. This may be because public nursery schools play a much more prominent role in small cities than in bigger ones. In core cities, municipalities are more likely to spend less on costly public facilities so that they can boost substitute childcare services offered by the private sector or other parties. They may even have more incentives to advance the privatization of public facilities. In contrast, public nursery schools are a necessity in small cities, which makes municipalities respond to resident demands through public facilities. Lastly, columns (5) and (6) show the case of towns and villages. Although the estimated coefficients (β_2) indicate a positive effect, similar to that for small cities, it is no longer statistically significant once we consider the year effect.

We now look at some of the control variables from Table.2. Except for the case of small cities, the ratio of preschool population to total population (PRESCHOOL) is statistically negative and significant with a small p-value, which implies that diseconomies of scale due to the decline in young child-population pushes up the operating costs. After controlling for time trend, a 1% increase in preschool children old enough to receive childcare service decreases childcare cost by approximately 0.6%. The coefficients of R1-2 are positive in all the cases implying that the high share of one- and two-year-old children pushes up the operating costs for public nursery schools. However, it is only significant in towns and villages. When we control for year effects, the coefficients of R0 and R3 are negative and statistically significant only in core cities. Since the cost of childcare is supposed to be inversely proportional to a child's age, this result is rather unexpected. The average wage is significant and positively associated with the dependent variable, as expected. In core and small cities, the temporary staff ratio has a negative and significant effect on childcare cost. The impact is more significant in small cities, with a 1% increase in the ratio triggering an approximate 0.45% decrease in childcare cost per enrolled child. The coefficient of CAPSCHOOL is negative and significant at almost 5% in core cities, and towns and villages, indicating the existence of economies of scale. The estimated coefficient of SUFFICIENCY is negatively significant only in small cities. In small cities where public nursery schools' sufficiency rate is higher, the municipality is likely to reduce

spending so that they can bridge the gap between supply and demand.

Table 3 presents the results of the DID estimation. The first column in each sample category considers the case with only the $NLAT$ dummy, whereas the second column reports the case with control variables. First, in the case of core cities, the estimated δ is negative and statistically significant (see columns (1) and (2)). Municipalities with no compensation through general resource revenue decrease per-enrolled-child operating cost by about 0.07% on average after controlling for other factors. This result admits the positive income effect of the compensation. Thus, in core cities, childcare service in public nursery schools can be regarded as a normal good. In the case of small cities, the result is the exact opposite of what happens in the core cities. The estimated coefficient of δ is positive and significant at 5%, as column (4) reports. In small cities, municipalities with no compensation through LAT increase per-enrolled-child operating cost by about 0.09% on average. That is, childcare service in public nursery schools can be considered an inferior good for municipalities in small cities. Columns (5) and (6) show the result for towns and villages; the estimated coefficient of δ is positive and implies the characteristics of an inferior good. However, it is insignificant and we fail to capture the average treatment effect of the reform. As for the other control variables, the significance and sign of coefficients are similar to the estimation results presented in Table 2.

Table1: Estimation results (full observations)

Dependen Var.: per-child operating cost for public nursery school	Pooled (1)	RE (2)	FE (3)	FE (4)	FEIV (5)
FCI*D2005	0.08***	0.068***	0.0672***	0.025	0.022
	(0.024)	(0.014)	(0.026)	(0.032)	(0.033)
FCI	0.035	-0.011	-0.110	0.034	0.045
	(0.034)	(0.039)	(0.128)	(0.116)	(0.114)
R0	0.120	0.118*	0.081	0.036	-0.030
	(0.090)	(0.064)	(0.073)	(0.075)	(0.087)
R1-2	0.985***	0.746***	0.600***	0.591***	0.673***
	(0.233)	(0.166)	(0.195)	(0.187)	(0.197)
R3	0.056	-0.069	-0.128	-0.108	-0.075
	(0.118)	(0.085)	(0.102)	(0.103)	(0.106)
PRESCHOOL	0.415***	-0.410***	-0.383**	-0.587***	-0.950***
	(0.068)	(0.072)	(0.173)	(0.202)	(0.308)
POP	0.100***	0.118***	-0.763**	-0.426	-0.212
	(0.015)	(0.018)	(0.338)	(0.394)	(0.457)
TAXPAYER	0.514***	-0.411***	0.401	0.235	0.263
	(0.109)	(0.128)	(0.260)	(0.245)	(0.246)
WAGE	0.626***	0.512***	0.317***	0.316***	0.316***
	(0.027)	(0.026)	(0.106)	(0.108)	(0.107)
TEMPORARY STAFF	-0.238***	-0.192***	-0.080	-0.074	-0.064
	(0.058)	(0.059)	(0.085)	(0.084)	(0.085)
CAPSCHOOL	-0.387***	-0.350***	-0.208**	-0.174**	-0.161*
	(0.039)	(0.043)	(0.088)	(0.088)	(0.087)
SUFFICIENCY	-0.056***	-0.036	0.034	0.005	-0.019
	(0.021)	(0.023)	(0.051)	(0.052)	(0.052)
year effect				-0.0878***	-0.119***
				(0.029)	(0.036)
Constant	1.092**	1.418***	11.77***	7.618*	
	(0.497)	(0.479)	(3.700)	(4.404)	
Observations	1,906	1,906	1,906	1,906	1,844
R-squared	0.330	0.126	0.149	0.159	0.152
Municipality fixed-effects	no	yes	yes	yes	yes
Number of municipality	983	983	983	983	922
F test that all Ui=0			F(982, 911) = 6.28***		
Breusch and Pagan LM test		chibar2(1) = 432.55***			
Hausman test			chi2(12)=86.59***		
likelihood ratio-test (specification model(3) or (4))				LR chi2(1) =22.47***	
F statistic(first stage)					61.00
Partial R-squared					0.313
Kleibergen-Paap rk LM statistic					49.25***
Hansen J statistic (p-value)					0.812
Tests of endogeneity of: PRESCHOOL Durbin-Wu-hausman test					1.173 Chi-sq(1)

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All independent and dependent variables are logarithmically transformed.

Source: Author

Table 2: Estimation results (observations by municipality scale)

Dependen Var.: per-child operating cost for public nursery school	Core cities		Small cities		Towns and Villages	
	FE	FE	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)
FCI*D2005	-0.164**	-0.251***	0.169***	0.107*	0.0628**	0.041
	(0.082)	(0.079)	(0.055)	(0.064)	(0.028)	(0.038)
FCI	0.377	0.733***	-0.104	0.119	-0.159	-0.081
	(0.361)	(0.272)	(0.224)	(0.231)	(0.145)	(0.136)
R0	-0.290	-0.871*	0.519*	0.296	0.035	0.021
	(0.488)	(0.453)	(0.272)	(0.309)	(0.075)	(0.077)
R1-2	1.328	0.665	0.845	0.742	0.524***	0.531***
	(1.168)	(0.813)	(0.706)	(0.691)	(0.192)	(0.190)
R3	-1.811***	-1.676***	-0.476	-0.400	-0.133	-0.123
	(0.614)	(0.461)	(0.388)	(0.377)	(0.103)	(0.106)
PRESCHOOL	0.163	-0.661**	-0.011	-0.319	-0.518***	-0.588***
	(0.432)	(0.323)	(0.250)	(0.292)	(0.199)	(0.218)
POP	-0.975	0.579	-0.628	-0.212	-0.524	-0.438
	(0.767)	(0.587)	(0.595)	(0.654)	(0.391)	(0.421)
TAXPAYER	0.569	-0.217	0.857	0.557	0.339	0.270
	(1.029)	(0.960)	(0.749)	(0.744)	(0.267)	(0.257)
WAGE	0.747***	0.773***	0.403***	0.393**	0.256**	0.258**
	(0.034)	(0.033)	(0.143)	(0.154)	(0.117)	(0.117)
TEMPORARY STAFF	-0.159	-0.165*	-0.467***	-0.458***	-0.005	-0.002
	(0.103)	(0.091)	(0.155)	(0.163)	(0.084)	(0.084)
CAPSCHOOL	-0.501*	-0.479**	-0.157	-0.108	-0.211**	-0.196**
	(0.269)	(0.228)	(0.173)	(0.171)	(0.092)	(0.093)
SUFFICIENCY	0.095	0.021	-0.162**	-0.188**	0.031	0.022
	(0.063)	(0.050)	(0.081)	(0.078)	(0.058)	(0.059)
year effect		-0.201***		-0.0924*		-0.047
		(0.042)		(0.053)		(0.040)
Constant	13.130	-10.980	12.30*	6.053	8.839**	7.769*
	(9.168)	(8.004)	(7.284)	(8.231)	(4.033)	(4.395)
Observations	148	148	340	340	1,418	1,418
R-squared (within)	0.916	0.938	0.44	0.452	0.118	0.12
Municipality fixed-effects	yes	yes	yes	yes	yes	yes
Number of municipality	81	81	175	175	734	734
likelihood ratio-test		LR chi2(1) =45.21***		LR chi2(1) =7.13***		LR chi2(1) = 3.14*

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All independent and dependent variables are logarithmically transformed.

Source: Author

Table 3: Estimation results (DID estimation)

Dependen Var.: per-child operating cost for public nursery school	Core cities		Small cities		Towns and Villages	
	(1)	(2)	(3)	(4)	(5)	(6)
non-LAT municipality	-0.1199*	-0.0730**	0.073	0.0937**	0.058	0.111
	(0.072)	(0.031)	(0.054)	(0.047)	(0.088)	(0.089)
⊿FCI		0.692**		0.090		-0.118
		(0.267)		(0.227)		(0.129)
⊿R0		-0.903**		0.289		0.019
		(0.424)		(0.305)		(0.077)
⊿R1-2		0.881		0.689		0.527***
		(0.796)		(0.689)		(0.187)
⊿R3		-1.677***		-0.400		-0.127
		(0.479)		(0.373)		(0.107)
⊿PRESCHOOL		-0.789**		-0.268		-0.609***
		(0.323)		(0.288)		(0.215)
⊿POP		0.263		-0.178		-0.301
		(0.600)		(0.634)		(0.343)
⊿TAXPAYER		-0.718		0.540		0.328
		(0.904)		(0.733)		(0.249)
⊿WAGE		0.782***		0.374**		0.258**
		(0.029)		(0.146)		(0.118)
⊿TEMPORARY STAFF		-0.129		-0.437***		-0.016
		(0.079)		(0.154)		(0.083)
⊿CAPSCHOOL		-0.522***		-0.132		-0.192**
		(0.195)		(0.176)		(0.093)
⊿SUFICIENCY		0.017		-0.180**		0.018
		(0.044)		(0.073)		(0.059)
Constant	-0.051***	-0.125**	-0.072***	-0.131***	-0.060***	-0.0881***
	(0.022)	(0.052)	(0.020)	(0.046)	(0.021)	(0.029)
Observations	69	69	171	168	744	685
R-squared	0.025	0.91	0.013	0.233	0.001	0.103

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

All independent and dependent variables are logarithmically transformed.

Source: Author

Table 4: Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
per-child operating cost for public nursery school	6.55	0.64	0.74	8.69	6.98	0.40	4.71	7.69	6.71	0.55	3.81	7.74	6.47	0.66	0.74	8.69
FCI	-0.86	0.69	-2.81	0.91	-0.11	0.20	-0.76	0.50	-0.28	0.28	-1.02	0.54	-1.08	0.65	-2.81	0.91
R0	-1.87	0.16	-3.26	-1.17	-1.81	0.06	-1.96	-1.65	-1.83	0.08	-2.10	-1.67	-1.89	0.17	-3.26	-1.17
R1-2	-0.74	0.07	-1.31	-0.41	-0.71	0.03	-0.77	-0.63	-0.72	0.04	-0.82	-0.60	-0.75	0.07	-1.31	-0.41
R3	-1.77	0.11	-2.81	-1.10	-1.78	0.02	-1.83	-1.72	-1.78	0.04	-1.89	-1.65	-1.77	0.13	-2.81	-1.10
PRESCHOOL	-2.98	0.22	-4.19	-2.40	-2.88	0.11	-3.18	-2.56	-2.87	0.15	-3.27	-2.41	-3.02	0.23	-4.19	-2.40
POP	9.87	1.39	5.31	15.09	12.56	0.61	11.92	15.09	11.29	0.31	10.82	11.92	9.25	0.95	5.31	10.82
TAXPAYER	-1.00	0.15	-1.73	-0.61	-0.88	0.07	-1.22	-0.76	-0.91	0.10	-1.36	-0.75	-1.03	0.16	-1.73	-0.61
WAGE	8.81	0.46	4.17	11.32	8.93	0.30	5.84	9.41	8.86	0.43	4.93	11.21	8.79	0.47	4.17	11.32
TEMPORARY STAFF	0.07	0.21	0.00	1.84	0.07	0.18	0.00	0.91	0.05	0.19	0.00	1.84	0.08	0.22	0.00	1.79
CAPSCHOOL	4.32	0.41	2.71	5.63	4.57	0.17	4.14	4.92	4.55	0.25	3.40	5.25	4.24	0.42	2.71	5.63
SUFFICIENCY	-0.35	0.67	-3.30	1.91	-0.83	0.59	-2.78	1.91	-0.68	0.63	-2.78	0.45	-0.22	0.64	-3.30	1.67
	1906				148				340				1418			

	ALL				Core cities				Small cities				Towns and Villages			
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
⊿per-child operating cost for public nursery school	-0.08	0.41	-3.91	2.97	-0.09	0.36	-0.70	2.56	-0.14	0.23	-0.76	0.95	-0.06	0.45	-3.91	2.97
non-LAT municipality	0.11	0.32	0.00	1.00	0.36	0.48	0.00	1.00	0.19	0.39	0.00	1.00	0.07	0.26	0.00	1.00
⊿FCI	0.11	0.11	-0.28	0.98	0.03	0.07	-0.12	0.19	0.06	0.07	-0.25	0.23	0.13	0.11	-0.28	0.98
⊿R0	-0.07	0.21	-1.75	1.38	-0.09	0.04	-0.18	0.02	-0.08	0.07	-0.27	0.10	-0.07	0.24	-1.75	1.38
⊿R1-2	-0.02	0.09	-0.68	0.46	-0.04	0.02	-0.09	0.02	-0.03	0.03	-0.13	0.05	-0.02	0.10	-0.68	0.46
⊿R3	0.02	0.15	-1.02	0.72	0.02	0.03	-0.07	0.08	0.02	0.05	-0.14	0.13	0.03	0.17	-1.02	0.72
⊿PRESCH	-0.07	0.10	-0.82	0.61	-0.05	0.05	-0.15	0.10	-0.06	0.06	-0.33	0.09	-0.07	0.12	-0.82	0.61
⊿POP	-0.02	0.05	-0.40	0.26	0.02	0.03	-0.04	0.16	0.01	0.03	-0.06	0.11	-0.03	0.05	-0.40	0.26
⊿TAXPAYER	-0.02	0.05	-0.33	0.23	-0.01	0.02	-0.05	0.04	-0.01	0.03	-0.09	0.06	-0.03	0.06	-0.33	0.23
⊿WAGE	0.02	0.36	-2.48	3.49	0.02	0.44	-0.33	3.49	-0.02	0.27	-2.24	1.16	0.03	0.36	-2.48	3.37
⊿TEMPORARY STAFF	0.03	0.20	-1.84	1.63	0.01	0.15	-0.46	0.69	-0.01	0.20	-1.84	0.51	0.04	0.20	-1.40	1.63
⊿CAPSCHOOL	0.03	0.17	-0.69	1.16	0.02	0.06	-0.22	0.15	0.04	0.10	-0.30	0.59	0.03	0.19	-0.69	1.16
⊿SUFFICIENCY	-0.07	0.32	-1.72	2.01	-0.11	0.28	-0.81	1.89	-0.10	0.23	-1.59	1.62	-0.06	0.34	-1.72	2.01
	922				69				168				685			

Source: Author

5. Conclusion

In the early 2000s, a series of structural reforms were initiated to give local governments more fiscal autonomy through decentralization. The 2004 change in the funding system for public nursery schools was one such initiative. This reform abolished the national subsidy for public nursery schools and compensated this loss with the LAT. Several studies have claimed that this change led to local governments spending less on public nursery schools, given their increasing autonomy. However, few studies examined this impact empirically. Using a panel dataset for municipalities across Japan for the years 2000 and 2005, we investigated the structural change in the impact of fiscal strength on operating costs for public nursery schools before and after the reforms and the average treatment effect of the reforms given that the revenue compensation through LAT was applied only to specific municipalities.

We found that large and small cities were likely to respond differently to the reforms. As to the first question, in areas with relatively large populations, such as core cities, fiscally stronger municipalities were likely to spend less on public nursery schools after the reforms. The share of private nursery schools, which are more flexible in meeting a growing demand, was higher in urban than in rural areas. Fiscally stronger municipalities tended to shrink the size of the public sector to shift the budget allocation from the public to the private sector or advance the privatization of public facilities. On the other hand, as public nursery schools play the role of a necessary good in small cities, fiscally stronger municipalities enriched the public sector when they had greater fiscal discretion. We did not observe any change in the impact of fiscal strength on public nursery school expenditures in towns and villages before and after the reforms. We utilized a DID approach to answer the second question since compensation for the loss of national subsidy was only applicable to LAT municipalities. We found that in core cities, municipalities that did not receive revenue compensation from LAT and faced a rise in the real price of public childcare services, decreased expenditures on public nursery schools. Thus, in these areas, childcare in public nursery schools can be regarded as a normal good. We found the opposite result in small cities, regardless of the rise in the real price of public childcare service. Municipalities tended to increase expenditures, implying that childcare service in public nursery schools is an inferior good.

Our paper shows how local governments reacted when they had more autonomy when dealing with public nursery school management. Their different responses, depending on the size of cities or fiscal capacity, reflect the differences in the role and positioning of public nursery schools in each region. Policymakers should pay more attention to such complex information to determine the best childcare policy. Further research is necessary for an updated picture of the current situation with regard to public nursery schools, examining not only the immediate impact but also the long-term influence of the reforms. Applying other indicators such as the progress of privatization may also be useful to provide deeper insights.

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Appendix

The variables used in this paper are defined as follows

- **Per enrolled child operating cost (y):**

Cost per child attending public nursery schools in the municipality, excluding a user charge burdened by households.

- **FCI:**

Fiscal capacity indicator in the municipality

- **R0:**

The share of infants aged 0 in the preschool population in the municipality

- **R1-2:**

The share of children aged 1 and 2 in the preschool population in the municipality

- **R3:**

The share of children aged 3 in the preschool population in the municipality

- **PRESCHOOL:**

The share of children under the age of 5 in total population in the municipality

- **POP:**

Population in the municipality

- **TAXPAYER:**

The share of taxpayers in total population in the municipality

- **WAGE:**

The regular personnel expense divided by the total number of administrative and nursery staff after deducting temporary staff

- **TEMPORARY STAFF:**

The share of temporary hired staff in total staff

- **CAPSCHOOL:**

The holding capacity of public nursery schools in the municipality

- **SUFFICIENCY:**

The ratio of total holding capacity of public nursery schools to the number of potential applicants in the municipality